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IM573

September, 2002

POWER WAVE PC BOARD REPLACEMENT CALIBRATION PROCEDURES

Safety Depends on You

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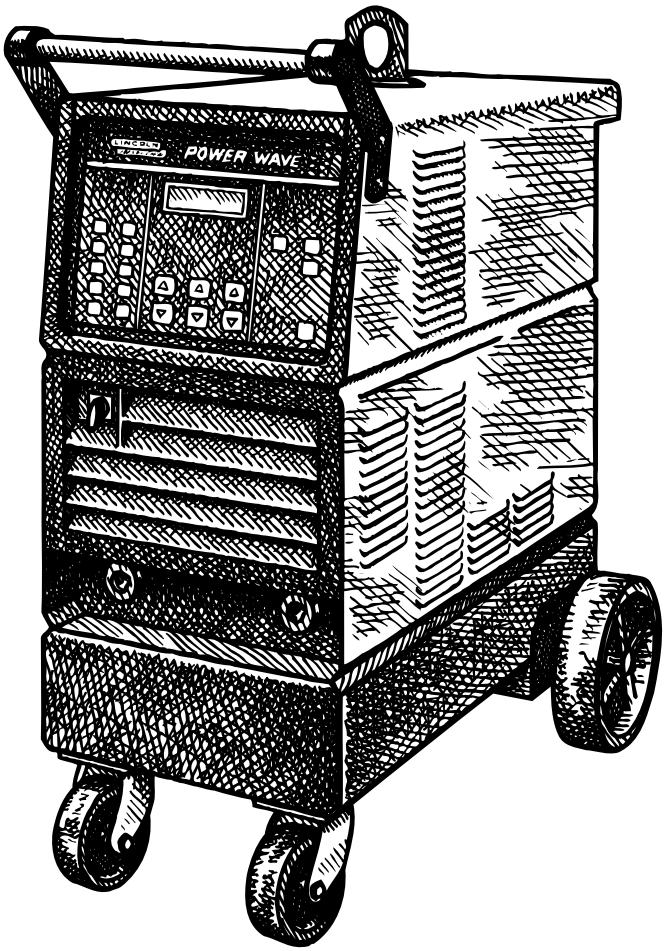

Date of Purchase: _____
Serial Number: _____
Code Number: _____
Model: _____
Where Purchased: _____

CALIBRATION PROCEDURES

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CALIBRATION

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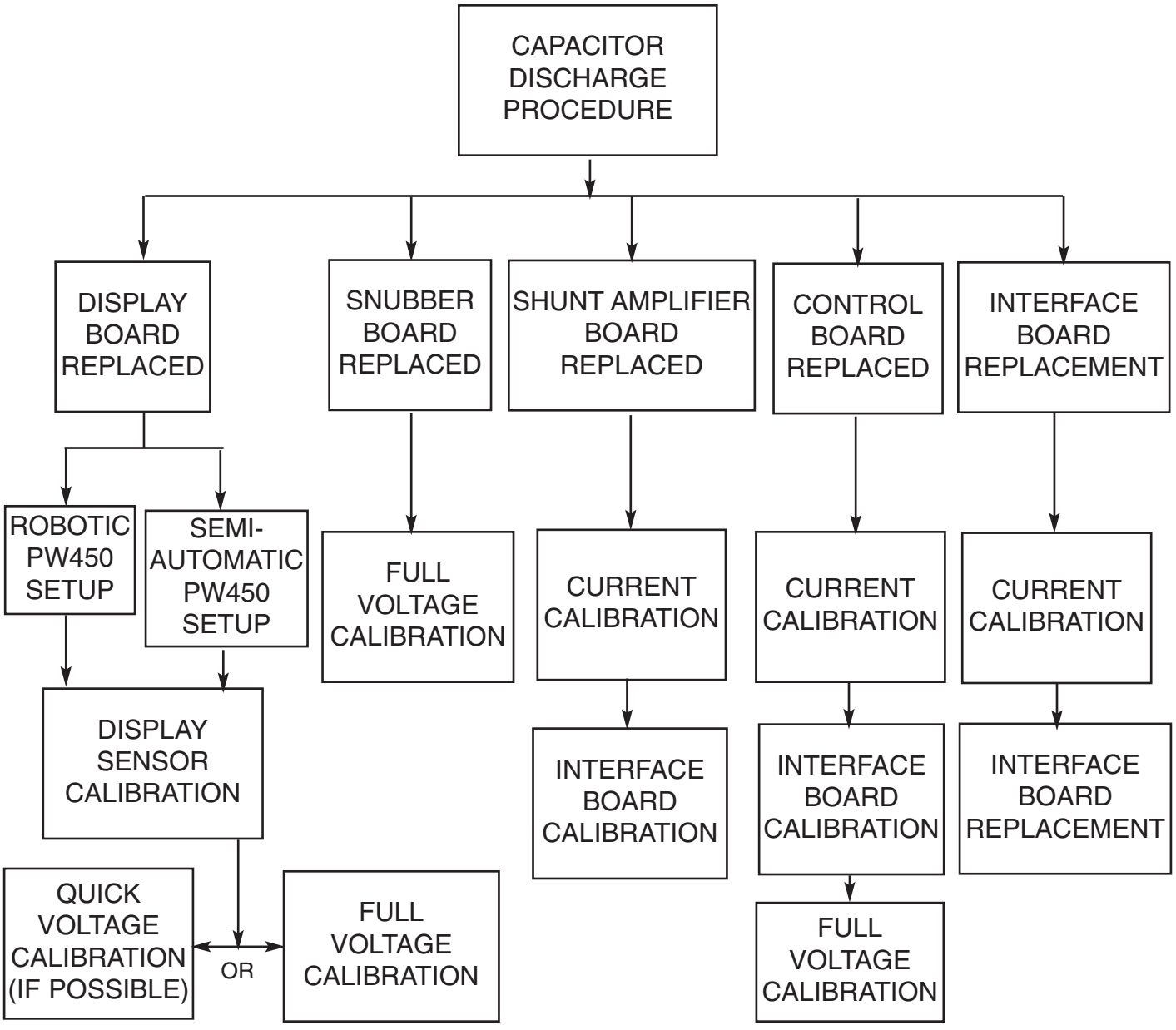


CALIBRATION

POWER WAVE PC BOARD REPLACEMENT CALIBRATION PROCEDURES

The following procedures provide instructions on how to properly perform sensor calibration, voltage calibration and current calibration on Power Wave power sources. Additionally a procedure is provided to properly discharge the Power Wave's input filter capacitors.

⚠ WARNING

Electric Shock Can Kill

- Only qualified personnel should service this equipment.
- Do not touch electrically hot parts.
- Prior to replacing any PC Boards or whenever working inside the Power Wave disconnect input power and perform the capacitor discharge procedure.

If the display board is replaced, the display sensor calibration and a voltage calibration must be performed for optimum performance. If the calibration is not done the voltage may be accurate only to within 3 volts.

If the sensor calibration is not done, the display board may have some problems sensing the correct overlay on power up.

⚠ CAUTION

The display is shipped with the water cooler disabled. If an internal water cooler is being used with the Power Wave, you must use the Setup Overlay L9660 to enable the water cooler before using the system.

If the control board is replaced, the voltage calibration and current calibration must be performed for optimum performance. If the calibration is not done, the voltage may be accurate only to within 3 volts and the current will be accurate only to within 15 amps.

CALIBRATION

CAPACITOR DISCHARGE PROCEDURE

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-800-833-9353 (WELD).

PURPOSE FOR THE PROCEDURE

This procedure will drain off any charge stored in the four large capacitors that are part of the FET switch board assembly. This procedure MUST be performed, as a safety precaution, before conducting any test or repair procedure that requires you to touch internal components of the machine.

MATERIALS NEEDED

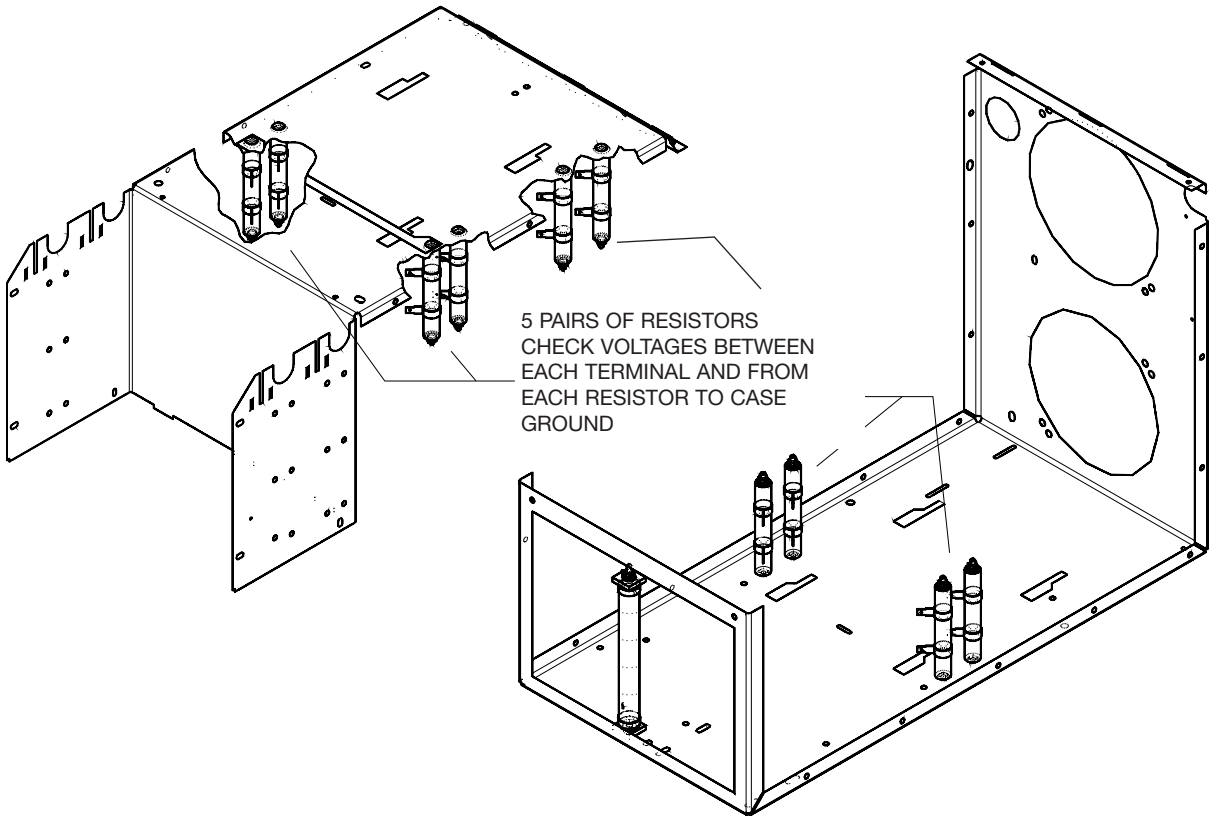
Volt/Ohmmeter (Multimeter)
5/16" Nut driver
3/8" Nut driver
Insulated gloves
Jumper wire with insulated leads and needle-nose ends
High wattage resistor - 25 to 1000 ohms, 25 watts minimum
Piece of glastic board or similar insulating materials on which to secure the resistor

CAPACITOR DISCHARGE PROCEDURE *(continued)*

TEST PROCEDURE

1. Remove main input supply power to the machine.
2. With the 3/8" nut driver, remove the screws that hold the handle to the machine.
3. Remove the rubber gasket (cover seal) from the lift bail.
4. With the 5/16" nut driver, remove the sheet metal screws from the case top.
5. With the 5/16" nut driver, remove the screws holding the right and left case sides. Remove the case sides by lifting up and out.
6. Obtain a high resistance and high wattage resistor (25 - 1000 ohms, 25 watts minimum). This resistor is not supplied with the machine. Secure this resistor to a piece of insulating material such as a glastic board. See Figure 3. NEVER USE A SHORTING STRAP FOR THIS PROCEDURE.
7. Locate the two sets of two resistors on the left side of the machine and three sets of two resistors on the right side of the machine. See Figure 1. Do not touch the resistors or any other internal machine component. Using a DC voltmeter, check for any DC voltage that may be present across the terminals of each resistor and from each resistor to case ground (20 measurements in all). If a voltage is present, be careful not to touch these resistors.
8. Locate terminals #9 and #12 on the switch boards. They can be identified by the “Discharge” labels, which are located on each of the four switch boards. See Figure 2.

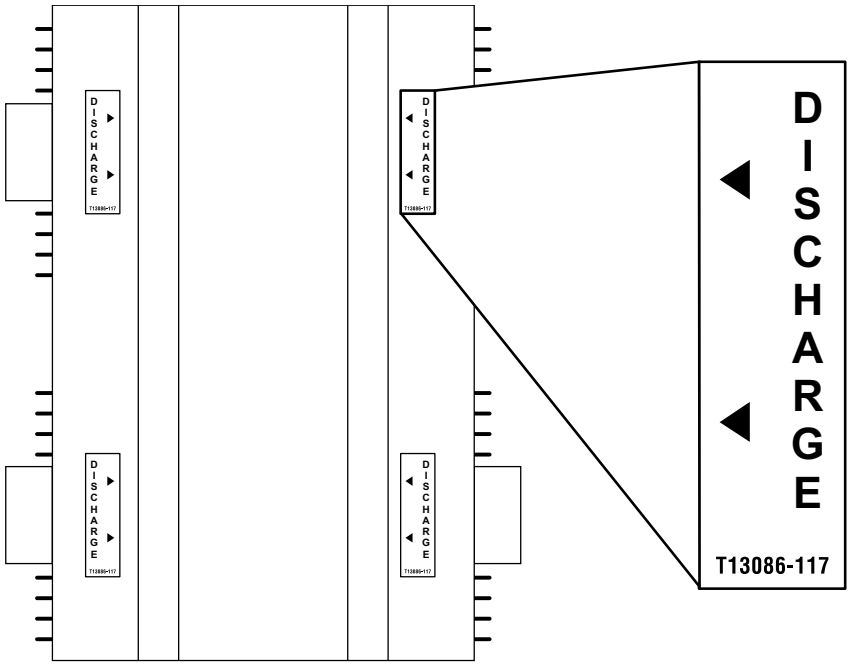
FIGURE 1 – RESISTOR LOCATIONS



CALIBRATION

CAPACITOR DISCHARGE PROCEDURE *(continued)*

FIGURE 2 – DISCHARGE LABEL



⚠ WARNING

ELECTRIC SHOCK can kill.

Proceed with caution. Be careful not to touch any internal machine components during the discharge procedure.

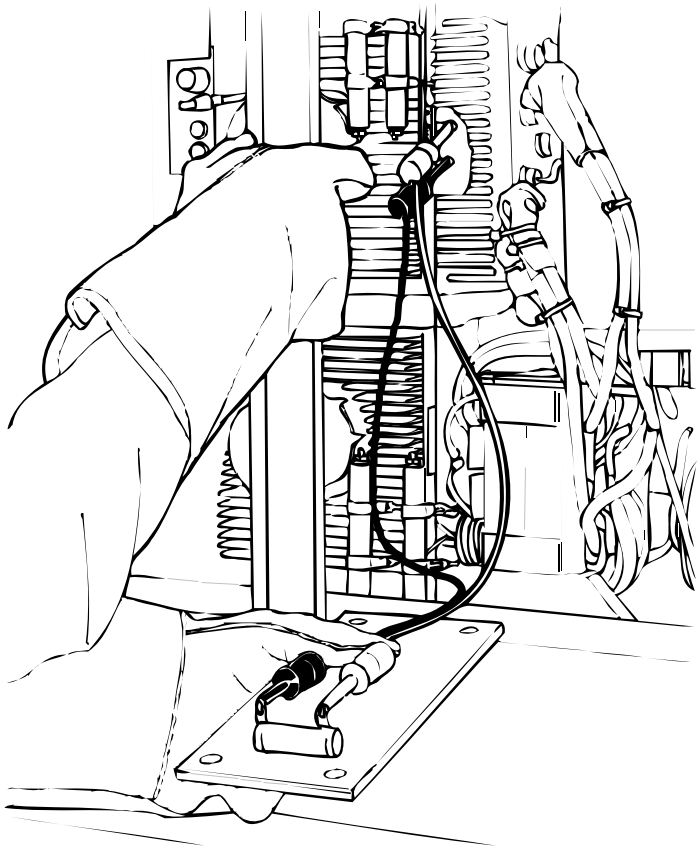
9. Using the insulated, needle nose type jumper leads and insulated gloves, connect one jumper lead to one end of the resistor obtained in step 6. Connect the other jumper lead to the other end of the resistor.

10. Carefully connect the needle nose end of one of the jumper leads to terminal #9. See Figure 3. Connect the needle nose end of the other jumper lead to terminal #12. Terminals #9 and #12 are indicated by the "Discharge" label. Leave the resistor connected for 10 seconds. DO NOT TOUCH TERMINALS, RESISTORS, OR ANY INTERNAL MACHINE COMPONENTS DURING THIS PROCEDURE!

CALIBRATION

CAPACITOR DISCHARGE PROCEDURE *(continued)*

FIGURE 3 - RESISTOR WITH LEADS CONNECTED.



11. Check the voltage across terminals #9 and #12 with the DC voltmeter. Terminal #9 has positive polarity and terminal #12 has negative polarity. Voltage should be zero. If any voltage remains, repeat this capacitor discharge procedure.
12. Repeat discharge procedure steps 9, 10, and 11 for each of the other three switch boards of the FET switch board assembly.

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CALIBRATION

SETUP FOR POWER WAVE 450 AFTER DISPLAY BOARD REPLACEMENT

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-800-833-9353 (WELD).

SETUP DESCRIPTION

This procedure properly enables the work and electrode sense leads after Display Board replacement.

MATERIALS NEEDED

Set-Up Overlay – L9660

Setting up the SemiAutomatic Power Wave 450 after Display Board replacement

After a Display board is installed, all users should verify the polarity, sense lead and water cooler conditions. Proceed as follows:

1. Insert the **SETUP** Overlay (L9660) and turn the Power Wave on.
2. For the majority of applications, the wire feeder LED's should look as follows (change settings as required to suit special applications):

Wire Feeder 1	Wire Feeder 2
Polarity LED "ON"	Polarity LED "ON"
Electrode Sense Lead Enabled LED "ON"	Electrode Sense Lead Enabled LED "ON"
Work Sense Lead Enabled LED "OFF"	Work Sense Lead Enabled LED "OFF"

3. If an external work sense lead (21 lead) is used, turn on the **WORK SENSE LEAD ENABLED LED** on **WIRE FEEDER 1**.
4. If a water cooler is used, enable and prime the water cooler using the water cooler **SETUP** keys.
5. Power down and remove the overlay.

Setting up the Robotic Power Wave 450 after Display Board replacement

After a Display board is installed, a special setup procedure is required to properly initialize the machine for robotic use. Proceed as follows:

1. Insert the **SETUP** Overlay (L9660) and turn the Power Wave on.
2. The **Wire Feeder 1 + POLARITY LED** should be on when the machine is first powered up. If not, proceed to step 4.
3. Turn the **+ POLARITY LED** for **WIRE FEEDER 1** off by pressing the **+/- POLARITY KEY** for **WIRE FEEDER 1.** Note that **WIRE FEEDER 2** LEDs will also change during this procedure.
4. Turn the **+ POLARITY LED** for **WIRE FEEDER 1** back on by again pressing the **+/- POLARITY KEY** for **WIRE FEEDER 1.**
5. When done properly, the LEDs should look as follows:

Wire Feeder 1	Wire Feeder 2
Polarity LED "ON"	Polarity LED "ON"
Electrode Sense Lead Enabled LED "ON"	Electrode Sense Lead Enabled LED "OFF"
Work Sense Lead Enabled LED "OFF"	Work Sense Lead Enabled LED "OFF"

6. If an external work sense lead (21 lead) is used, turn on the **WORK SENSE LEAD ENABLED LED** on **WIRE FEEDER 1**.
7. If a water cooler is used, enable and prime the water cooler using the water cooler **SETUP** keys.
8. Power down and remove the overlay.

CALIBRATION

SENSOR CALIBRATION TEST (FOR DISPLAY BOARD)

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-800-833-9353 (WELD).

TEST DESCRIPTION

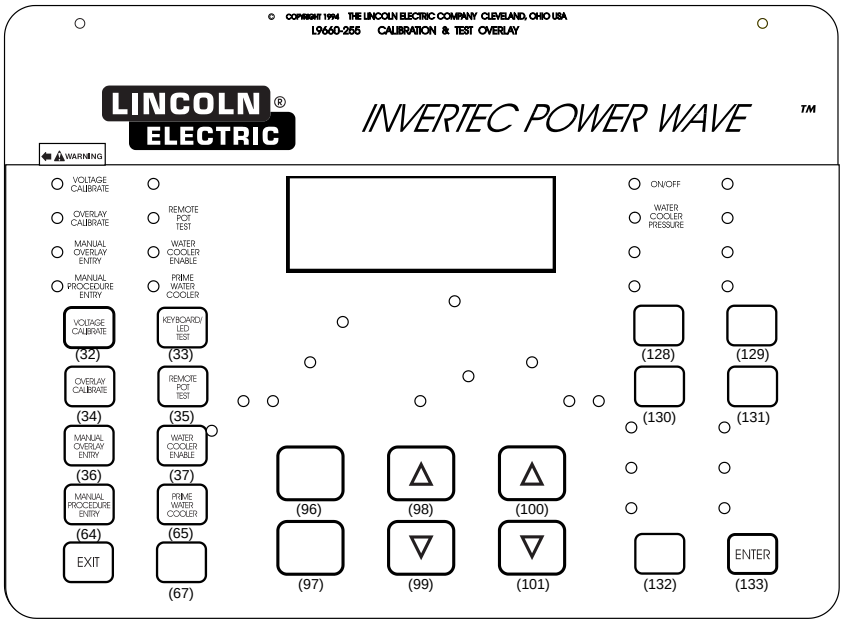
This procedure recalibrates the eight overlay sensors of the Power Wave.

MATERIALS NEEDED

Power Wave Test and Calibration Overlay – L9660-255
Set-Up Overlay – L9660

SENSOR CALIBRATION TEST (FOR DISPLAY BOARD) *(continued)*

Figure 4 - SENSOR LOCATION BEHIND OVERLAY



PROCEDURE

1. Insert the CALIBRATION AND TEST overlay (L9660-255). If this overlay is not available, turn the machine ON with no overlay in place and refer to Figure 4 to identify the keys. The overlay ID number is momentarily displayed if the overlay is in place. The number on the display should be 255.

2. When the display reads SELECT A FUNCTION, press key #34 - OVERLAY CALIBRATE. The OVERLAY CALIBRATE light turns on and momentarily the display reads:

   OVERLAY SENSOR
   CALIBRATION

Then the display changes to read:

   INSERT REF OVRLY
   PRESS ENTER . . .

Insert the SETUP overlay (L9660).

4. Press key #133 - ENTER. This key is not identified on the SETUP overlay. It is located in the lower right hand corner. Refer to Figure 4 above for location. The machine will begin to calibrate the eight overlay sensors.

5. If one of the sensors could not be calibrated, the display reads:

   SENSOR X FAILED
   ENTER TO RETRY

   Make sure the overlay is lined up properly and press key #133 - ENTER. This will cause the machine to try to calibrate the sensor again. If a particular sensor continues to fail, clean the sensors or remove the case top and make sure the DISPLAY board is seated all the way down on the mounting posts. Also check wiring connections. If calibration still fails, record the calibration numbers, if possible, using the QUICK VOLTAGE CALIBRATION procedure before removing the DISPLAY board.

6. If the calibration procedure is successful, the display reads:

   CALIBRATION
   SUCCESSFUL

After a few seconds the display changes to read:

   INSERT CAL OVRLY
   PRESS ENTER . . .

7. Press key #133 - ENTER. the OVERLAY CALIBRATE LED turns off, the machine exits the OVERLAY CALIBRATE function and the display reads:

   SELECT A FUNCTION

8. Turn the power switch SW1 to the OFF position. To use the machine, place the appropriate overlay in position and turn power switch SW1 to the ON position.

NOTE: Turn power switch SW1 to the OFF position and get the overlay that was not recognized by the power wave. Replace the TEST overlay with this overlay and turn the machine ON. The machine should recognize the overlay now. If it does not, the overlay is faulty.

CALIBRATION

SEMIAUTOMATIC PW450 QUICK VOLTAGE CALIBRATION

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-800-833-9353 (WELD).

PROCEDURE DESCRIPTION

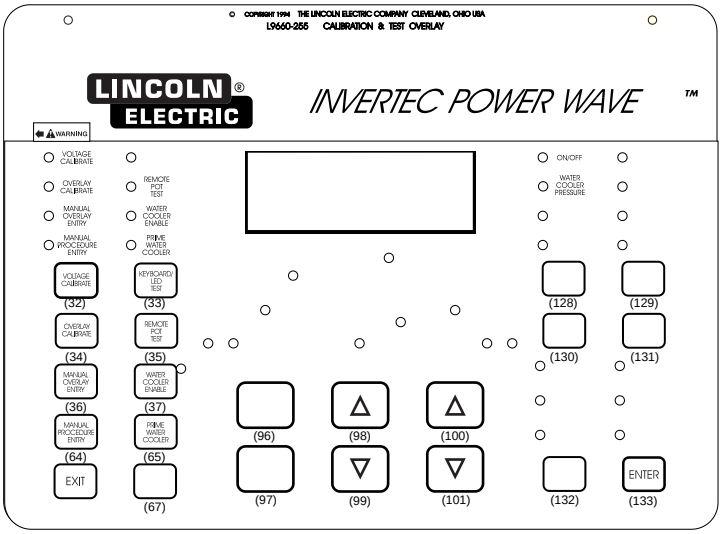
This procedure is a quick way of calibrating the voltage sensing points (leads), provided that the existing display board is capable of displaying the calibration numbers that are stored in the display board.

MATERIALS NEEDED

A known “good” replacement display board
A Test and Calibration overlay L9660-255

SEMIAUTOMATIC PW450 QUICK VOLTAGE CALIBRATION *(continued)*

Figure 5 - TEST AND CALIBRATION OVERLAY



PROCEDURE

1. Before changing or disturbing the defective display board, power up the machine with the L9660-255 Test and Calibration overlay in place. See Figure 5.
2. Press the Voltage Calibration function (32). The machine should display the following:

VOLTAGE WIRE
+ POLARITY (+67A)

3. Press the Enter Key (133) on the lower right side of the overlay. The machine should display the following:

ADJUST TO 30V
CALIBRATION #=XX

NOTE: Here “XX” indicates a particular calibration number for a given voltage sensing point.

⚠ WARNING

The machine’s output terminals will be electrically “HOT” when the Enter Key is pressed.

4. Record the number displayed for the +67 wire and press the Enter Key (133) again.
5. Repeat the process by pressing the Voltage Calibration function again. The next sensing lead may be selected by pressing the down Arrow Key (101). The above procedure must be repeated six times to obtain and record the calibration number for six different voltage sensing points. These points are the following:

+ Polarity (+67A)
- Polarity (+21A)
+ Polarity (+67B)
- Polarity (+21B)
+ Polarity
- Polarity

6. Install the “new” replacement display board.
7. With the L9660-255 overlay installed, apply power to the machine. Press the Voltage Calibration function (32). Enter the recorded calibration numbers for each of the six voltage sensing points. The calibration numbers are entered by selecting the proper sensing point (lead), pressing the Enter Key (133) and obtaining the display that reads:

ADJUST TO 30V
CALIBRATION #=XX

The calibration number is changed using the up/down Arrow Keys (100, 101). Press the Enter Key when the desired number is displayed.

8. Repeat the process for all six sensing points (leads).
9. Perform the Sensor Calibration Test.

CALIBRATION

ROBOTIC PW450 QUICK VOLTAGE CALIBRATION

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-800-833-9353 (WELD).

PROCEDURE DESCRIPTION

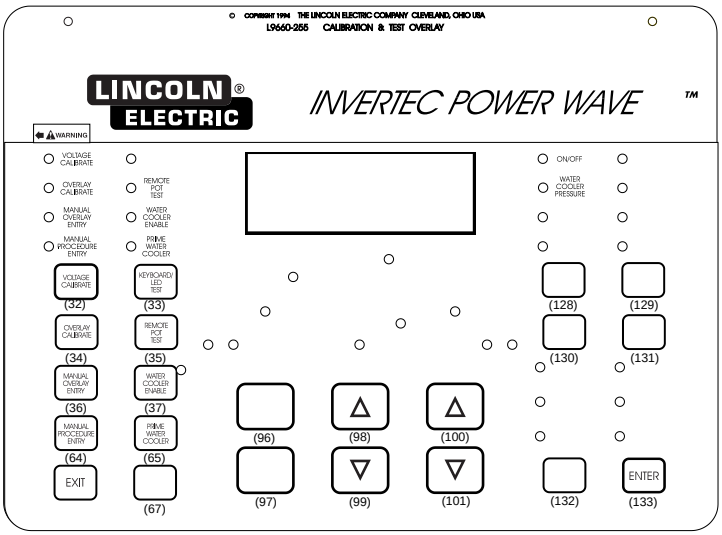
This procedure is a quick way of calibrating the voltage sensing points (leads), provided that the existing display board is capable of displaying the calibration numbers that are stored in the display board.

MATERIALS NEEDED

A known “good” replacement display board
A Test and Calibration overlay L9660-255

ROBOTIC PW450 QUICK VOLTAGE CALIBRATION *(continued)*

Figure 5 - TEST AND CALIBRATION OVERLAY



PROCEDURE

1. Before changing or disturbing the defective display board, power up the machine with the L9660-255 Test and Calibration overlay in place. See Figure 5.
2. Press the Voltage Calibration function (32). The machine should display the following:

   VOLTAGE WIRE
   + POLARITY (+67A)

3. Press the Enter Key (133) on the lower right side of the overlay. The machine should display the following:

   ADJUST TO 30V
   CALIBRATION #=XX

NOTE: Here "XX" indicates a particular calibration number for a given voltage sensing point.

⚠ WARNING

The machine's output terminals will be electrically "HOT" when the Enter Key is pressed.

4. Record the number displayed for the +67 wire and press the Enter Key (133) again.
5. Repeat the process by pressing the Voltage Calibration function again. The next sensing lead may be selected by pressing the down Arrow Key (101). The above procedure must be repeated four times to obtain and record the calibration number for four different voltage sensing points. These four points are the following:

   + Polarity (+67A)
   - Polarity (+21A)
   + Polarity
   - Polarity

6. Install the "new" replacement display board.
7. With the L9660-255 overlay installed, apply power to the machine. Press the Voltage Calibration function (32). Enter the recorded calibration numbers for each of the six voltage sensing points. The calibration numbers are entered by selecting the proper sensing point (lead), pressing the Enter Key (133) and obtaining the display that reads:

   ADJUST TO 30V
   CALIBRATION #=XX

   The calibration number is changed using the up/down Arrow Keys (100, 101). Press the Enter Key when the desired number is displayed.

8. Repeat the process for all six sensing points (leads).
9. Perform the Sensor Calibration Test.

SEMIAUTOMATIC PW450 FULL VOLTAGE CALIBRATION

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-800-833-9353 (WELD).

PROCEDURE DESCRIPTION

This procedure is necessary if the display board is replaced and the Quick Voltage Calibration is NOT possible. The Full Voltage Calibration is also necessary if the snubber and/or control boards are replaced.

MATERIALS NEEDED

A Test and Calibration Overlay L9660-255
A 300 amp, 30 volt resistive grid load. (A MIG welding load may be used if a grid load is not available. Choose an argon rich 30 volt spray procedure.) See the topic Full Voltage Calibration Using a Welding Arc in this section of the manual.
A calibrated DC voltmeter* accurate to 30.0 volts +/- 0.1 volt.
A set of jumper leads to access the remote voltage sensing leads in the wire feeder amphenol receptacles.

* Some voltmeters will not read accurately because of the 40 KHz ripple present on the output.

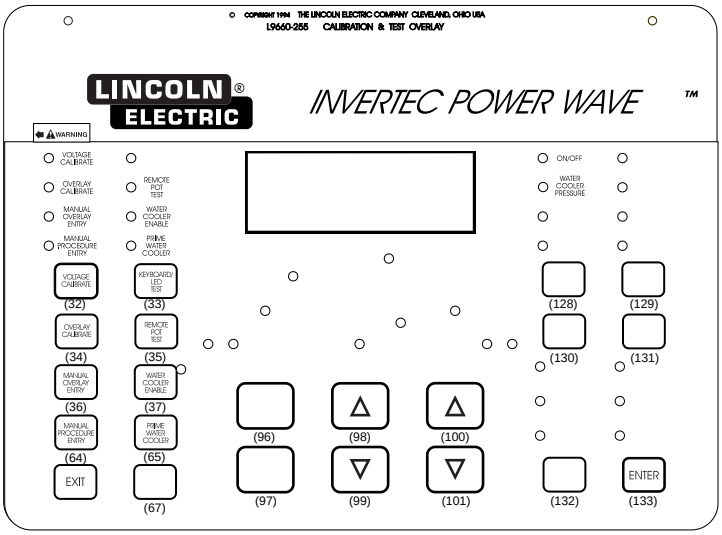
SETUP PROCEDURE

1. Using the jumper leads, connect 21A (H) and 67A (N), located in wire feeder receptacle #1, to the machine's positive output terminal.
2. Using the jumper leads, connect 21B (H) and 67B (N), located in wire feeder receptacle #2, to the machine's positive output terminal.
3. Connect the resistive grid load (or wire feeder) to the machine's output terminals.
4. Connect the DC voltmeter to the machine's output terminals. Do not connect the voltmeter to the load. This avoids erroneous readings due to cable drop.

CALIBRATION

SEMIAUTOMATIC PW450 FULL VOLTAGE CALIBRATION*(continued)*

Figure 6 - TEST AND CALIBRATION OVERLAY



PROCEDURE

1. The voltage calibration numbers are stored in the display board. They are programmable from the front panel using the Test and Calibration Overlay.
2. Change the PC board in question.
3. Install the Test and Calibration Overlay L9660-255 and power up the machine. See Figure 6.
4. Press the Voltage Calibration function (32). The machine should display the following:

   VOLTAGE WIRE
   + POLARITY (+67A)

5. Press the Enter Key (133) on the lower right side of the overlay. The machine should display the following:

   ADJUST TO 30V
   CALIBRATION #=XX

NOTE: Here "XX" indicates a particular calibration number for a given voltage sensing point.

⚠ WARNING

The machine's output terminals will be electrically "HOT" when the Enter Key is pressed.

6. With the machine loaded, monitor the reference voltage only (external voltmeter). It is the only important reading. Adjust the voltage using the Arrow Keys (100 and 101) until the reference voltmeter reads 30.0 volts. Press the Enter Key.

⚠ CAUTION

WHEN LOADING THE MACHINE WITH THE CASE PARTS REMOVED, BE CAREFUL NOT TO OVERHEAT THE MACHINE.

7. Repeat the process by pressing the Voltage Calibration function again. The next voltage sensing point (lead) may be selected by pressing the down Arrow Key (101). The above procedure must be repeated six times to set the six sensing points (leads) to 30.0 volts. The six test points (leads) are the following:

   + Polarity (+67A)
   - Polarity (+21A)
   + Polarity (+67B)
   - Polarity (+21B)
   + Polarity
   - Polarity

8. If the display board is replaced or disturbed, perform the Sensor Calibration Test.

ROBOTIC PW450 FULL VOLTAGE CALIBRATION

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-800-833-9353 (WELD).

PROCEDURE DESCRIPTION

This procedure is necessary if the display board is replaced and the Quick Voltage Calibration is NOT possible. The Full Voltage Calibration is also necessary if the snubber and/or control boards are replaced.

MATERIALS NEEDED

A Test and Calibration Overlay L9660-255
A 300 amp ±10%, 30 volt resistive grid load. (A MIG welding load may be used if a grid load is not available. Choose an argon rich 30 volt spray procedure.) See the topic Full Voltage Calibration Using a Welding Arc in this section of the manual.
A calibrated DC voltmeter* accurate to 30.0 volts +/- 0.1 volt.
A set of jumper leads to access the remote voltage sensing leads in the wire feeder amphenol receptacles.

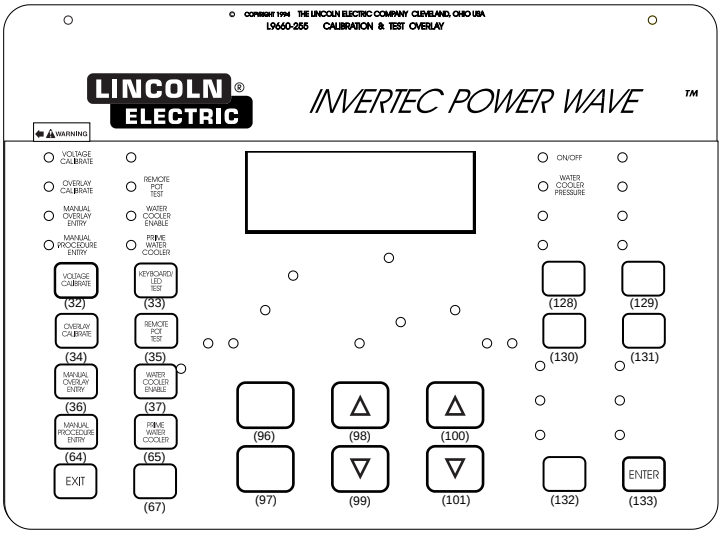
* Some voltmeters will not read accurately because of the 40 KHz ripple present on the output.

SETUP PROCEDURE

1. Using the jumper leads, connect wire #67, pin (N), located in wire drive receptacle P83, to the machine's positive output terminal.
2. Using the jumper leads, connect wire #21A, pin (H), located in the auxiliary receptacle P84, to the machine's positive output terminal.
3. Connect the resistive grid load (or wire feeder) to the machine's output terminals.
4. Connect the DC voltmeter to the machine's output terminals. Do not connect the voltmeter to the load. This avoids erroneous readings due to cable drop.

ROBOTIC PW450 FULL VOLTAGE CALIBRATION*(continued)*

Figure 6 - TEST AND CALIBRATION OVERLAY



PROCEDURE

1. The voltage calibration numbers are stored in the display board. They are programmable from the front panel using the Test and Calibration Overlay.
2. Change the PC board in question.
3. Install the Test and Calibration Overlay L9660-255 and power up the machine. See Figure 6.
4. Press the Voltage Calibration function (32). The machine should display the following:

   VOLTAGE WIRE
   + POLARITY (+67A)

5. Press the Enter Key (133) on the lower right side of the overlay. The machine should display the following:

   ADJUST TO 30V
   CALIBRATION #=XX

NOTE: Here "XX" indicates a particular calibration number for a given voltage sensing point.

⚠ WARNING

The machine's output terminals will be electrically "HOT" when the Enter Key is pressed.

6. With the machine loaded, monitor the reference voltage only (external voltmeter). It is the only important reading. Adjust the voltage using the Arrow Keys (100 and 101) until the reference voltmeter reads 30.0 volts. Press the Enter Key.

⚠ CAUTION

WHEN LOADING THE MACHINE WITH THE CASE PARTS REMOVED, BE CAREFUL NOT TO OVERHEAT THE MACHINE.

7. Repeat the process by pressing the Voltage Calibration function again. The next voltage sensing point (lead) may be selected by pressing the down Arrow Key (101). The above procedure must be repeated four times to set the four sensing points (leads) to 30.0 volts. The four test points (leads) are the following:

   + Polarity (+67A)
   - Polarity (+21A)
   + Polarity
   - Polarity

8. If the display board is replaced or disturbed, perform the Sensor Calibration Test.

CALIBRATION

SEMIAUTOMATIC PW450 FULL VOLTAGE CALIBRATION USING A WELDING ARC

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-800-833-9353 (WELD).

PROCEDURE DESCRIPTION

This procedure is necessary if the display board is replaced and the Quick Voltage Calibration or the Normal Full Voltage Calibration is NOT possible.

MATERIALS NEEDED

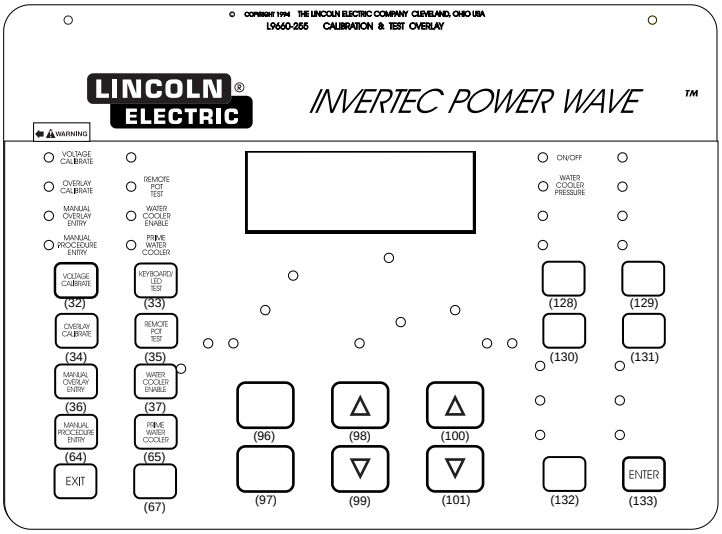
A Test and Calibration overlay L9660-255 (the test procedure can be done without this)
A Synergic 7 wire feeder.
A calibrated DC voltmeter accurate to 0.1 volts at 30.0 volts.
The proper welding wire and gas combination to produce a Spray Arc. For example, 0.035 L-50 wire with a 90% Argon and 10% CO_2 blend of gas.

SETUP PROCEDURE

1. Connect a DC voltmeter to the machine's negative output terminal and the conductor block of the wire feeder.
2. Connect the Synergic 7 wire feeder to the Wire Feeder 1 receptacle on the back of the Power Wave.

SEMIAUTOMATIC PW450 FULL VOLTAGE CALIBRATION USING A WELDING ARC *(continued)*

Figure 7 - TEST AND CALIBRATION OVERLAY



PROCEDURE

1. The voltage calibration numbers are stored in the display board. They are programmable from the front panel using the Test and Calibration Overlay.
2. Change the display board in question.
3. Install the Test and Calibration overlay L9660-255 (or do not insert any overlay into the machine) and power up the machine. See Figure 7. If the -255 overlay is not available, use Figure 1 as a guide to see which keys to press.
4. Press the Voltage Calibration function (32). The machine should display the following:

   VOLTAGE WIRE
   + POLARITY (+67A)

5. Press the Enter Key (133) on the lower right side of the overlay. The machine should display the following:

   ADJUST TO 30V
   CALIBRATION# = XX

NOTE: Here “xx” indicates a particular calibration number for a given voltage sense point.

⚠ WARNING

The machine’s output terminals will be electrically “HOT” when the Enter Key is pressed.

6. Adjust the wire feed speed on the Synergic 7 to 500 IPM (some wire feed speed to get into the spray range).

NOTE: When the Enter Key is pressed it will clear the wire feed speed to 200 IPM. The wire feed speed must be adjusted after pressing the Enter Key but before starting to weld.

7. Pull the trigger on the torch and start to weld. Hold a long stick out. This is not normally a welding technique. The starting will be poor. The welding may be poor. Maintain a long, steady welding arc. While welding, monitor the reference voltage only (external voltmeter). It is the only important reading. Adjust the voltage using the Arrow Keys (100 and 101) until the reference voltmeter reads 30.0 volts. Record the number on the display, “xx”. Press the Enter Key. Release the trigger on the torch.
8. Repeat the process by pressing the Voltage Calibration function (32) again. The next voltage sensing point may be selected by pressing the down Arrow Key (101). Repeat steps 5, 6, and 7 for the following test points.

SEMIAUTOMATIC PW450 FULL VOLTAGE CALIBRATION USING A WELDING ARC *(continued)*

– POLARITY (+21A)
+ POLARITY
– POLARITY

NOTE: Do not attempt to weld for –Polarity (+21A). Set the number to the same as recorded for +Polarity (+67A). Also for +Polarity and –Polarity, move the voltmeter sense lead from the conductor block of the wire feeder to the positive output terminal on the front of the machine.

9. Turn the machine off. Connect the Synergic 7 to the Wire feeder 2 amphenol on the back of the Power Wave machine.

10. Put the voltmeter sense lead back on the wire feeder conductor block and repeat the calibration process steps 5, 6, and 7 for the following test points:

+POLARITY (+67B)
–POLARITY (+21B)

NOTE: Do not attempt to weld for –Polarity (+21B). Set the number to the same as recorded for +Polarity (+67B).

SEMIAUTOMATIC PW450 CURRENT CALIBRATION

⚠ WARNING

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If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-800-833-9353 (WELD).

PROCEDURE DESCRIPTION

This procedure is necessary if the control and/or the shunt amplifier boards are replaced. The current control is the most critical function in the Power Wave machine.

MATERIALS NEEDED

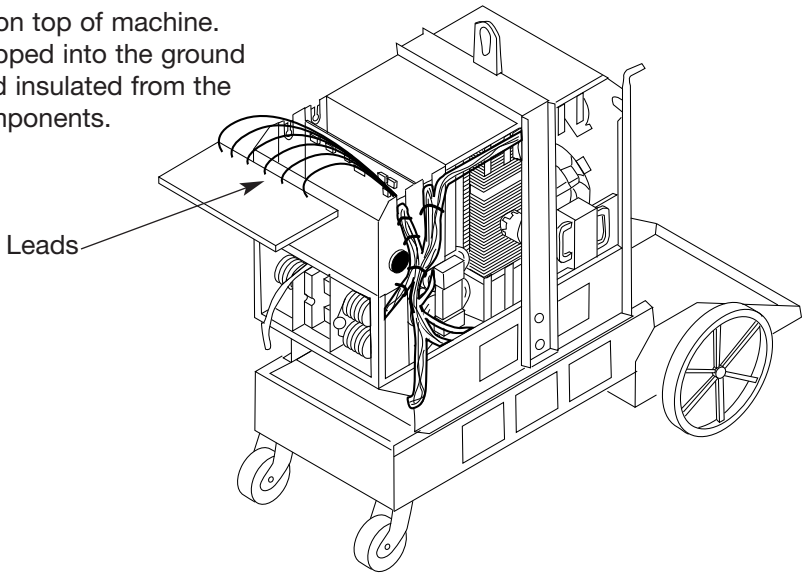
Test and Calibration Overlay L9660-255
A 300 amp, 30 volt resistance grid load
A small trimmer screwdriver
A calibrated DC ammeter accurate to read 300.0 amps +/- 1.0 amps.
A machine output triggering device such as the K941-1 Remote Control Kit.

SETUP PROCEDURE

1. Remove and install the replacement board in question.

Figure 8 – PC BOARD REMOVED BUT STILL CONNECTED

Lay Control Board on top of machine. Make sure it is snapped into the ground plane assembly and insulated from the case and other components.



SEMIAUTOMATIC PW450 CURRENT CALIBRATION *(continued)*

2. Locate the 10 turn trimmer potentiometer located on the control board. It is the only trimmer on the board. If the trimmer is not accessible with the control board installed, then the board must be removed and laid on the top of the PC board compartment. Be sure the control board is insulated from the other boards and the case parts. All wiring plugs must be connected to the control board. See Figure 8.

⚠ WARNING

WHEN THE MACHINE CASE IS REMOVED HIGH VOLTAGE POINTS ARE EXPOSED.

STAND DIRECTLY IN FRONT OF MACHINE UNDER TEST.

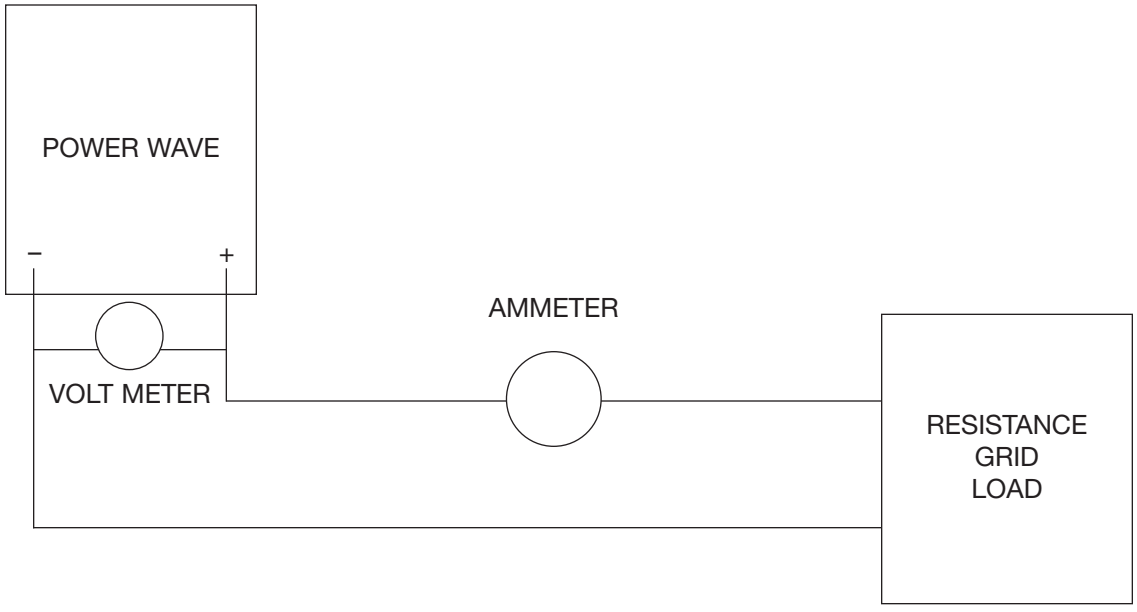
EXPLODING PARTS CAN CAUSE INJURY. FAILED PARTS CAN EXPLODE OR CAUSE OTHER PARTS TO EXPLODE WHEN POWER IS APPLIED. ALWAYS WEAR A FACE SHIELD AND LONG SLEEVES WHEN SERVICING.

⚠ CAUTION

WHEN LOADING THE MACHINE WITH THE CASE PARTS REMOVED. BE CAREFUL NOT TO OVER HEAT THE MACHINE.

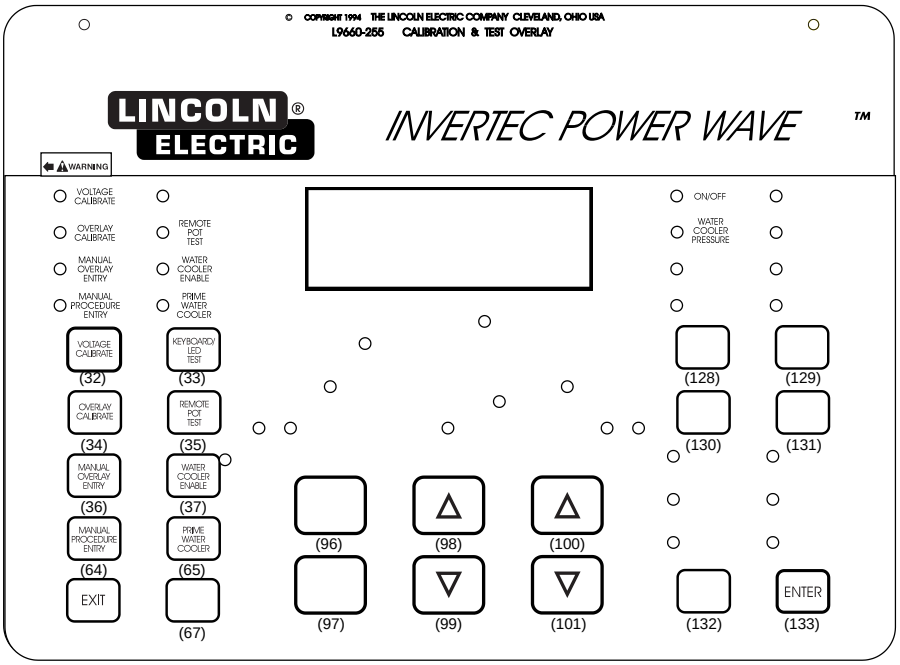
3. **NOTE:** If a wire feeder is NOT connected to the Power Wave the machine may not display output volts.
4. Connect the resistance grid load to the machine's output terminals. Connect the reference ammeter in series with the grid load. See Figure 9.

FIGURE 9 – RESISTANCE GRID LOAD CONNECTIONS



SEMIAUTOMATIC PW450 CURRENT CALIBRATION *(continued)*

Figure 10 – TEST AND CALIBRATION OVERLAY



PROCEDURE

1. Install the Test and Calibration Overlay and apply power to the machine. See Figure 10.
2. Press the Manual Procedure Entry Key (64). The machine should display the following:

   PROCESS 1 SETUP
   1-0

3. Toggle the Arrow Keys (100 and 101) until the display reads:

   PROCESS 1 SETUP
   1-6

4. Activate the external trigger device. (K941-1) and load the machine.

⚠ WARNING

The machine's output terminals will be electrically "HOT" when the trigger circuit is activated.

5. Adjust the potentiometer until the reference (external ammeter) reads 304 amps +/- 1.0 amps. The load voltage should be greater than 15 volts but less than 35 volts.
6. Remove power to the machine.
7. If necessary re-install the control board.
8. Replace the machine case parts.

ROBOTIC PW450 CURRENT CALIBRATION

⚠ WARNING

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PROCEDURE DESCRIPTION

This procedure is necessary if the control and/or the shunt amplifier boards are replaced. The current control is the most critical function in the Power Wave machine.

MATERIALS NEEDED

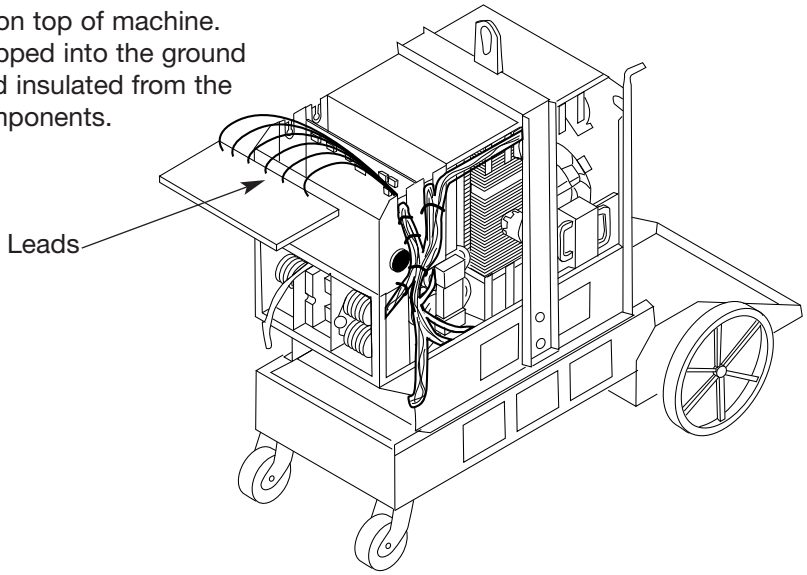
Test and Calibration Overlay L9660-255
A 300 amp, 30 volt resistance grid load
A small trimmer screwdriver
A calibrated DC ammeter accurate to read 300.0 amps +/- 1.0 amps.

SETUP PROCEDURE

1. Remove and install the replacement board in question.

Figure 8 – PC BOARD REMOVED BUT STILL CONNECTED

Lay Control Board on top of machine. Make sure it is snapped into the ground plane assembly and insulated from the case and other components.



ROBOTIC PW450 CURRENT CALIBRATION *(continued)*

2. Locate the 10 turn trimmer potentiometer located on the control board. It is the only trimmer on the board. If the trimmer is not accessible with the control board installed, then the board must be removed and laid on the top of the PC board compartment. Be sure the control board is insulated from the other boards and the case parts. All wiring plugs must be connected to the control board. See Figure 8.

⚠ WARNING

WHEN THE MACHINE CASE IS REMOVED HIGH VOLTAGE POINTS ARE EXPOSED.

STAND DIRECTLY IN FRONT OF MACHINE UNDER TEST.

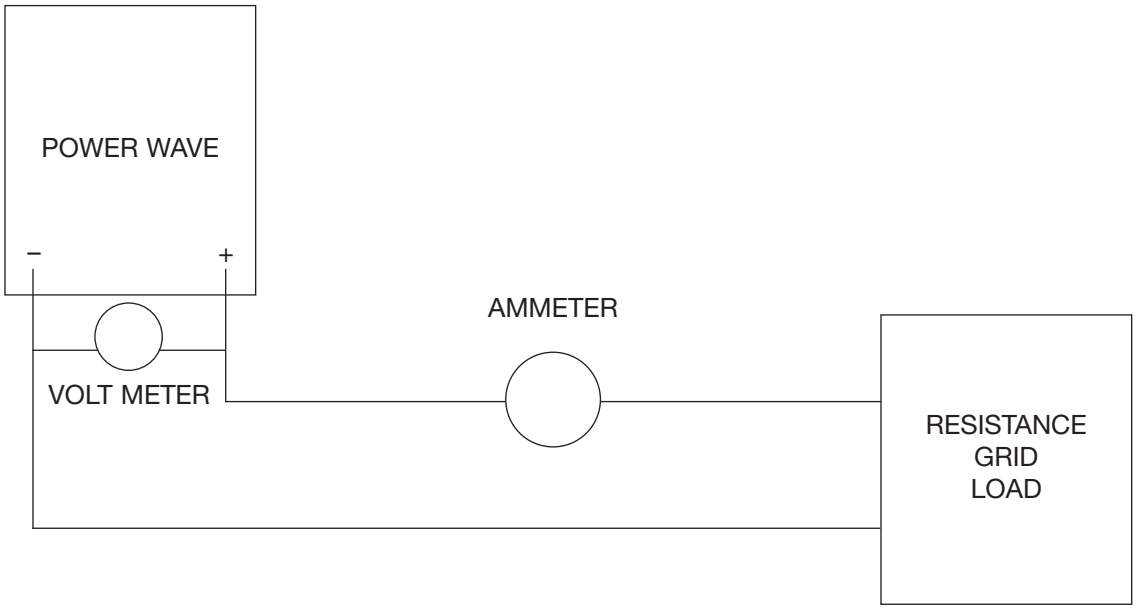
EXPLODING PARTS CAN CAUSE INJURY. FAILED PARTS CAN EXPLODE OR CAUSE OTHER PARTS TO EXPLODE WHEN POWER IS APPLIED. ALWAYS WEAR A FACE SHIELD AND LONG SLEEVES WHEN SERVICING.

⚠ CAUTION

WHEN LOADING THE MACHINE WITH THE CASE PARTS REMOVED. BE CAREFUL NOT TO OVER HEAT THE MACHINE.

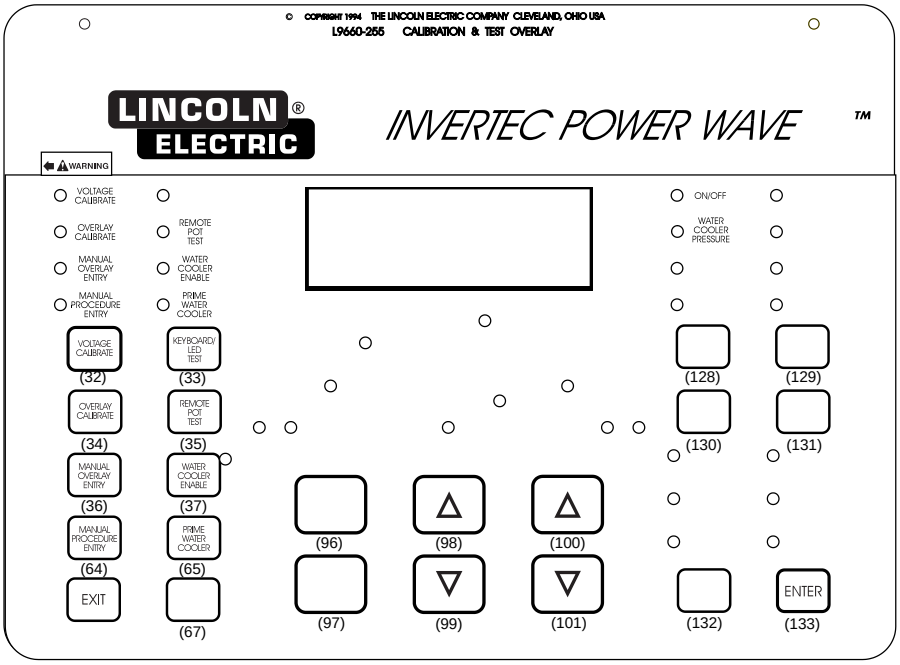
3. **NOTE:** If a wire feeder is NOT connected to the Power Wave the machine may not display output volts.
4. Connect the resistance grid load to the machine's output terminals. Connect the reference ammeter in series with the grid load. See Figure 9.

FIGURE 9 – RESISTANCE GRID LOAD CONNECTIONS



ROBOTIC PW450 CURRENT CALIBRATION *(continued)*

Figure 10 – TEST AND CALIBRATION OVERLAY



PROCEDURE

1. Install the Test and Calibration Overlay and apply power to the machine. See Figure 10.
2. Press the Manual Procedure Entry Key (64). The machine should display the following:

   PROCESS 1 SETUP
   1-0

3. Toggle the Arrow Keys (100 and 101) until the display reads:

   PROCESS 1 SETUP
   1-6

4. Trigger the PW450 and apply the load. (See EXTERNAL TRIGGERING CIRCUIT) on the next page.

⚠ WARNING

The machine's output terminals will be electrically "HOT" when the trigger circuit is activated.

5. Adjust the potentiometer until the reference (external ammeter) reads 304 amps +/- 1.0 amps. The load voltage should be greater than 15 volts but less than 35 volts.
6. Remove power to the machine.
7. If necessary re-install the control board.
8. Replace the machine case parts.

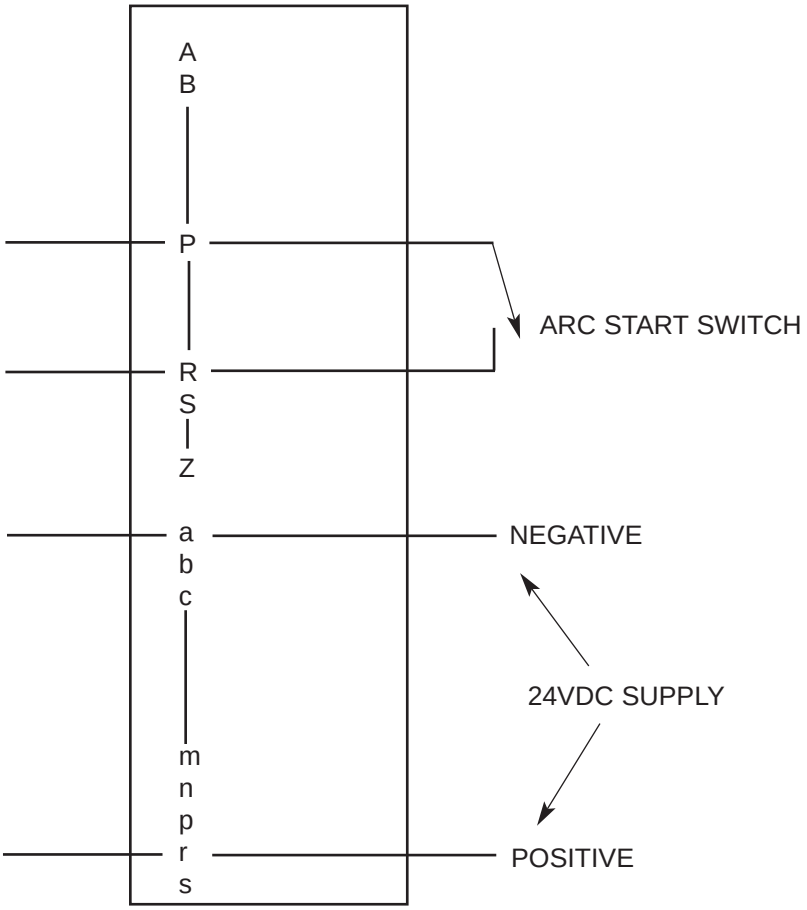
CALIBRATION

EXTERNAL TRIGGERING CIRCUIT

The Power Wave 450 Robotic may be triggered independent of the robot using the following circuit and procedure.

1. Remove the large connector plug on the rear of the PW450. (As viewed from the front of the machine).
2. Connect a normally open switch and a 24VDC supply either to the large connector plug (P82) or to the harness connectors on the interface board. See the following table and figure.
3. When the 24VDC supply is correctly wired in place and turned on the welding output terminals can be energized by closing the switch.

Voltage / Switch Signal	P82 Connector Pins	Interface Board Connectors
24VDC @ 100ma	P82 - r(+) P82 - a(-)	J106 - 3 Wire #534 J106 - 4 Wire #535
Normally open switch	P82 - R P82 - P	J105 - 4 Wire #518 J105 - 12 Wire #527



P82
ROBOT
RECEPTACLE

CALIBRATION

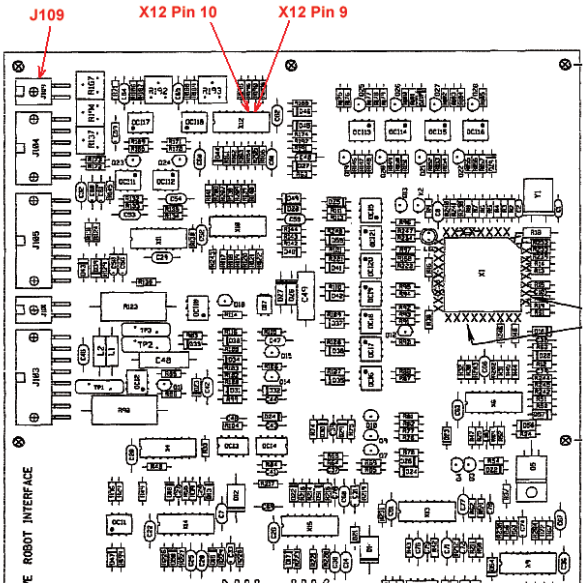
ROBOTIC INTERFACE P.C. BOARD CALIBRATION

Position Interface board on top of the power wave so that the component side is up. Make certain a non-conductive insulating material is protecting the control board from touching any conductive surface. Locate the J109 receptacle. Directly next to the receptacle, are three trimmers side-by–side. We are interested in the center trimmer, the R 194, (reference Interface P.C.board drawing below). Once you have located the three trimmers, follow on down and locate the X-12 integrated circuit.

With the board positioned as described and plugged into the wiring harness, connect a DC voltmeter to pin 2 of J109 Positive and pin 4 J109, Negative. Turn on the Power wave and after the contactor pulls in, read the voltmeter. A reading of 11 volts or more indicates that the R194 trimmer needs to be calibrated.

1. Turn the R194 trimmer fully counter clockwise. Slowly turn it clockwise until the voltage on the meter switches from 11+ volts to less than 1 volt. Repeat step one a couple of times, starting at the full counter-clockwise position, until you are sure that you are just at the point of change from high voltage to low.
2. Remove the positive probe from the J109 pin 2 position and attach it to lead nine of X-12. Leave the negative lead at J109 pin 4. The voltmeter should now be reading less than one volt. (Example) 0.345 MV.
3. Slowly continue to adjust the trimmer clockwise until the voltage reading has increased 100 MV, (0.100 volt) + or - 0.025 volt. (EXAMPLE, 0.420 to 0.470).

INTERFACE P.C. BOARD



QUICK SHUNT BOARD TEST

The following procedure can be used to check for instability in the Power Wave 450 Shunt circuitry.

1. Disconnect the **output** welding leads from the machine.
2. Turn on the Power Wave 450, and release the drive roll tension in the wire feeder, so the machine will not feed wire.
3. If semi automatic power source, Pull the gun trigger, and hold for several seconds.
4. Trigger the machine several times and observe the (“ **I** =”) reading on the front of the power wave, while the output is on.

The value shown must be less than (5) amps with the machine triggered. If after several triggers the value of the shunt reading (“ **I** =”) is at or above (5) amps, the shunt is suspect and needs to be replaced. If the value of shunt offset is below (5) amps, the stability is at an acceptable level. If problems continue, perform the **output shunt / welding feed back test.**

ROBOTIC INTERFACE CONNECTIONS

POWER WAVE INTERFACE BOARD

J101-1	+Serial loop	CTRL J27-1
J101-2	High speed sense 1	P83-K
J101-3	High speed sense 2	P83-L
J101-4	-Serial loop	CTRL J27-4

J103-1	+42VDC	Full wave bridge
J103-2	-42VDC	Full wave bridge
J103-3	Touch 2-4 output (2)	PROT J34-4
J103-4	Touch 2-4 output (4)	PROT J34-7
J103-5	Tach PWR	P83-G
J103-6	Tach signal	P83-F
J103-7	Tach GND	P83-H
J103-8	Motor+	P83-A
J103-9	Motor-	P83-B
J103-10	Weld 2-4 output (2)	PROT J34-11
J103-11	Weld 2-4 output (4)	PROT J34-14
J103-12	Gas solenoid+	P83-C
J103-13	Gas solenoid-	P83-D
J103-14	67 Sense lead	P83-N
J103-15		
J103-16		

J104-1	Voltage signal	CTRL J21-4
J104-2	Current signal	CTRL J21-7
J104-3	Water PWR	D.K. J16-4
J104-4	+output signal	SNUB J60-3
J104-5	-output signal	SNUB J61-4
J104-6	Water signal	D.K. J16-5
J104-7	Control GND	CTRL J24-11
J104-8	TRIM command	D.K. J10-12 (TIG)
J104-9	WFS command	D.K. J10-2 (WF1)
J104-10	Display analog GND	D.K. J10-13
J104-11	Water GND	D.K. J16-12
J104-12	67 Sense lead	SNUB J60-8

J105-1	Isolated voltage signal	P82-J (ADCH1)
J105-2	Isolated current signal	P82-L (ADCH2)
J105-3	Abnormal operation signal	P82-h (WDI6)
J105-4	Arc start command	P82-[ ]* (WDO1)
J105-5	Arc detect signal	P82-d (WDI2)
J105-6	Gas flow command	P82-S (WDO2)
J105-7	Gas shortage signal	P82-e (WDI3)
J105-8	DPS command	P82-X (WDO7)
J105-9	Positive inch command	P82-U (WDO4)
J105-10	Negative inch command	P82-V (WDO5)
J105-11	Short detect signal (+)	P82-N (WDI-)
J105-12	Short detect signal (-)	P82-P (WDI-)
J105-13	Isolated water signal	P82-g (WDI5)
J105-14	Touch sense command	P82-T (WDO3)
J105-15	Voltage command	P82-A (DACH1)
J105-16	WFS command	P82-E (DACH2)

J106-1	Touch sense signal	CTRL J24-4
J106-2	Isolated touch sense signal	P82-c (WDI1)
J106-3	Robot +24V	P82-r (+24E)
J106-4	Robot GND	P82-a (0V)
J106-5	Robot analog GND	P82-F (COMDA2)
J106-6	Spare robot output	P82-Z (WDO8)
J106-7	Gas shortage input	P84-A
J106-8	Gas shortage GND	P84-B

ARCTOOL WELDING INPUTS AND OUTPUTS

CRW1-1	DACH1	Voltage command	P82-A
CRW1-2	COMDA1		P82-F
CRW1-3	DACH2	WFS command	P82-E
CRW1-4	COMDA2	WFS command GND	P82-F
CRW1-5	WDI1	(Touch sense signal)	P82-c
CRW1-6	WDI2	Arc detect	P82-d
CRW1-7	WDI3	Gas fault	P82-e
CRW1-8	WDI4		P82-f
CRW1-9	WDI5	Water fault	P82-g
CRW1-10	WDI6	Power fault	P82-h
CRW1-11	WDI7		P82-j
CRW1-12	WDI8		P82-k
CRW1-13	ADCH1	Voltage feedback	P82-J
CRW1-14	COMAD1		P82-K
CRW1-15	ADCH2	Current feedback	P82-L
CRW1-16	COMAD2		P82-M
CRW1-17			
CRW1-18			
CRW1-19	0V	Robot GND	P82-a
CRW1-20	0V		P82-b
CRW1-21	0V		P82-m
CRW1-22	0V		P82-n
CRW1-23	WDO1	Weld start	P82-R
CRW1-24	WDO2	Gas start	P82-S
CRW1-25	WDO3	(Touch sense command)	P82-T
CRW1-26	WDO4	Wire+	P82-U
CRW1-27	WDO5	Wire-	P82-V
CRW1-28	WDO6		P82-W
CRW1-29	WDO7	(Dual procedure switch command)	P82-X
CRW1-30	WDO8	(Spare robot output)	P82-Z
CRW1-31	WDI+	Wire stick detect	P82-N
CRW1-32	WDI-	Wire stick detect	P82-P
CRW1-33	+24V	Robot PWR	P82-r
CRW1-34	+24V	Robot PWR	P82-r
			P82-H
			P82-s

*
- P82-R Fanuc models
- P82-C Motoman models

MISCELLANEOUS CONNECTIONS

P84-A	Gas shortage input
P84-B	Gas shortage GND

TEST PROCEDURE AFTER REPAIR

31

The following five steps should be completed after examining and or repairing a Power Wave 450R. These steps will insure that all aspects and systems of the Power Wave are functioning. This procedure does not include fan operation, or proper water cooler operation, both of which are industry standard systems not requiring specific technical interpretation. It is assumed that the repair technician is familiar with the basic functions of the Power Wave and how to determine that the machine is powering up correctly and understands the overlay system and memory operations. Additionally, those systems, if not functioning properly, should be clearly apparent to the technician.

After completing repairs, and or cleaning the unit, and while bearing in mind and following all safety precautions listed in the service manual, proceed as follows.

1. Check to insure the 5 Amp circuit breaker on the lower front of the machine does not trip when the machine is on. A tripping breaker indicates a faulty I full wave bridge rectifier mounted on the left side of the control box, or a defective Interface printed circuit board

2. Remove the cover to the control box, look at the component side of the Interface board, and with the power on, observe a flashing LED on the Interface board. If LED is not flashing, replace Interface board.

3. Disconnect the power, and measure the resistance from**:**
   P83 feeder connector pin F to J103 pin 6 at the Interface board connector.
   P83 feeder connector pin G to J103 pin 5 at the Interface board connector.
   P83 feeder connector pin H to J103 pin 7 at the Interface board connector.
   Each resistance check should yield a maximum resistance of 6.5 ohms, with no continuity between any two individual F, G or H pins.
   If a high resistance on one lead is found or two leads shorting together, locate the T12218-7 inductors soldered into the harness you are checking and replace or repair the condition. Recheck.

4. Complete the voltage, current, and Interface board calibration. The calibration procedures are provided in the IM 573 and additional up-dated information appears the latest service CD.

5. Replace covers on the machine, and attempt to trigger the unit following the procedure listed in the EXTERNAL TRIGGERING CIRCUIT procedure in the Power Wave PC Board Replacement Calibration Procedures, IM 573. Pay close attention to the polarity of the 24V. DC. Incorrect polarity will result in damage to the Interface board, Verify O.C.V.

These steps, along with the expected contactor closure and display information will insure that all circuits of the Power Wave 450 are operational.

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